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(71) Applicant
The Secretary of State for Defence, Whitehall, London SW1A 2HB

(72) Inventors
William Denis Delany,
Roger Terrence Matthews
(74) Agent
D. B. Wildman

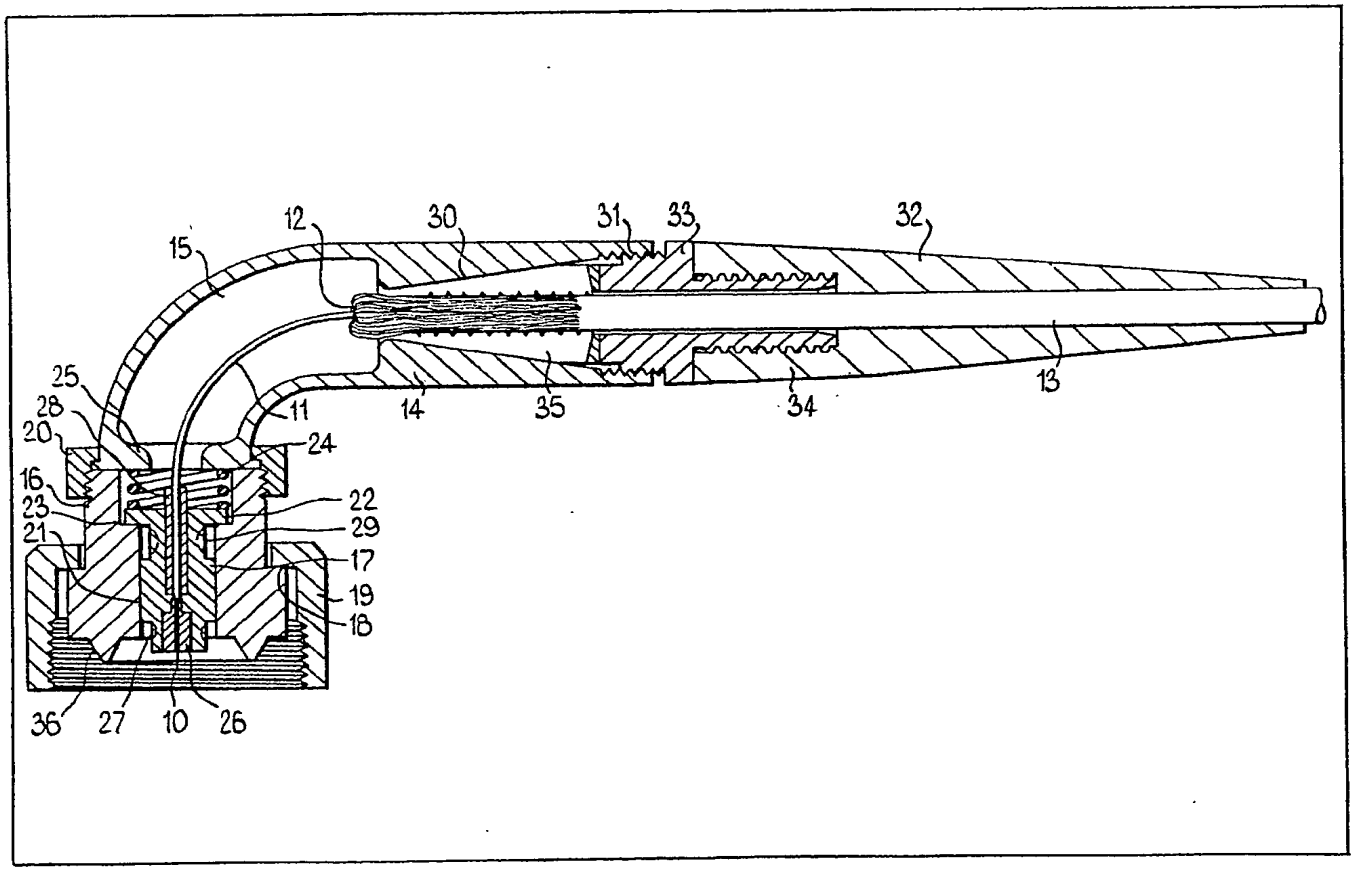
(54) **Fibre optic connectors**

(57) The invention relates to fibre optic connectors and provides a means of protecting the fibre within the connector from externally applied strains.

The connector has a fibre (10)/ferrule (17) assembly at its connecting end and means (30—35) in the region of its other end for securely gripping the sheath (13) of the fibre optic cable (10, 11).

Located within the connector between the fibre optic (10)/ferrule (17) assembly and the sheath (13) gripping means is a strain relieving chamber (15) through which the fibre (10, 11) extends in a manner whereby strain applied to the fibre (10—13) externally of the connector is isolated from the fibre optic (10)/ferrule (17) assembly.

The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.



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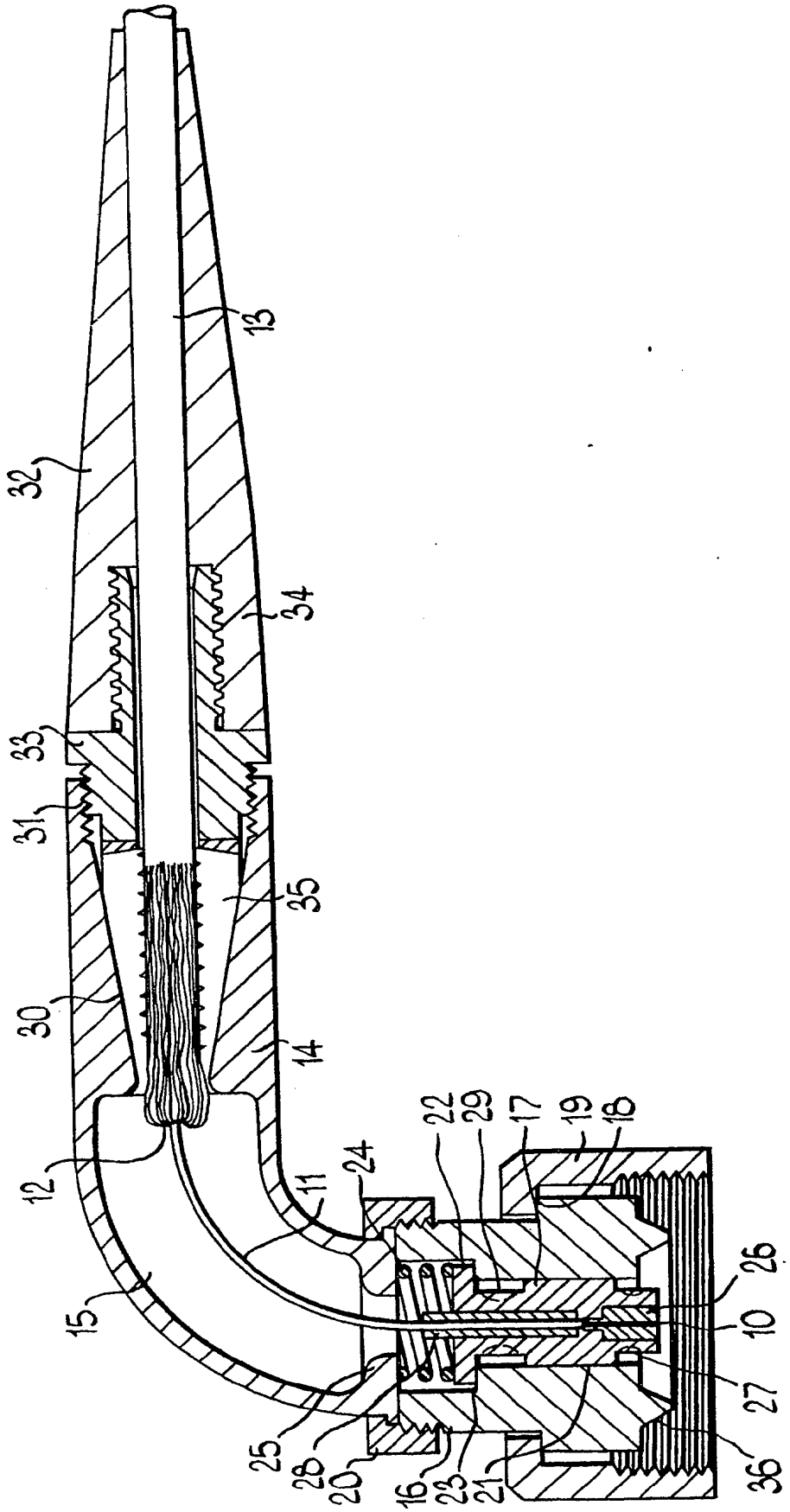

SPECIFICATION

Improvements in or relating to fibre optic connectors

This invention relates to fibre optic connectors.

The importance of alignment and clean interface contact between opposing fibres in the design of fibre optic connectors is well appreciated. Many fibre optic connectors are available which meet adequately these design criteria and which function satisfactorily under laboratory or ideal on-site situations. In certain fields of use however the fibre optic cables and in some cases the connectors are subjected to unintentional or accidental mishandling which can result in undesirable strain being put on the fibre in the connector. It is known for example, that interface contact between the fibres of mating cables can be lost even when the connectors are fully connected.

It is an object of the present invention to provide a fibre optic connector in which interface contact of the fibre ends is maintained even when the fibre within the connector is subjected to externally originating strain.

According to the present invention a fibre optic connector has a fibre mounted ferrule assembly at its connecting end and means in the region of its other end for securely holding the end length of the sheath of the fibre optic cable and a chamber therebetween through which the fibre extends in a manner whereby strain applied to the fibre externally of the connector is isolated, or substantially so, from the fibre/ferrule assembly.

The fibre optic connector conveniently comprises a main body portion including the strain relieving chamber and a forward body portion housing the fibre/ferrule assembly. In a preferred arrangement the fibre optic connector is an angled connector with the fibre following an arcuate path through the chamber whereby any strain applied to the fibre is relieved by the elasticity of the fibre in assuming an alternative arcuate path of different radius of curvature.

Advantageously the fibre optic and its primary sheath are held in the ferrule by means of crimping thus removing the need for the commonly used adhesives. The fibre/ferrule assembly is preferably resiliently retained within the forward body portion of the connector; this can be for example by a stiff spring acting to urge the exposed end of the fibre against its operative interface position.

The fibre/ferrule assembly is accurately located within the forward body portion of the connector, which portion preferably includes alignment means for co-location with the fibre optic system to which the connector is to be connected. The alignment means might conveniently be an annular "V"-section projection for co-location with a corresponding annular "V"-section groove in the mating part. The stiff spring might also conveniently be housed within the forward body portion, being effective to maintain the forward body exposed end of the fibre/ferrule assembly in the space bounded by the annular "V"-section projection.

The main body portion of the connector may be formed essentially of two halves which clamp together to retain the forward body portion at one end whilst securely gripping the cables outer sheath and tensile strength fibres at the other end. Alternatively, and preferably, the main body portion is essentially of integral construction of rubber, plastics or metal material moulded, clamped or crimped on to the forward body portion and cable sheath and tensile strength fibres. The forward body portion preferably includes a captive nut for efficient firm connection of the connector to its mating part.

An embodiment of the invention will now be described by way of example only with reference to the accompanying diagrammatic drawing which shows a section through a fibre optic connector of the invention.

The drawing shows a fibre optic connector for use with an optical fibre cable comprising a 400 micron core (550 micron cladding) diameter optical fibre 10 having a primary sheath 11 of plastics material overlayed longitudinally with tensile strengthening fibres 12 and a secondary outer sheath 13.

The connector comprises a main body portion 14 having a "strain relieving" chamber 15 and a forward body portion 16 housing a ferrule 17 in which the primary sheath 11 and the optical fibre 10 are crimped.

The forward body portion 16 is generally cylindrical and has a radial step 18 approximately half way down its length against which a captive nut 19 bears; a thread is provided at the rear end to take a clamp nut 20 to secure the main body portion 14 against the forward body portion 16.

Ideally the main body portion 14 and the forward body portion 16 should have an indexing system allowing the two body portions to be set at a given radial angle relative to each other. The ferrule 17 is located in an accurately machined forward region of a stepped bore 21 in the forward body portion 16. The ferrule 17 is retained within the forward body portion 16 by means of a radial flange 22 which is urged into a butting relationship with a step 23 in the bore 21 by means of a stiff spring 24 held in position by a radially inwardly projecting portion 25 of the main body portion 14. The ferrule 17 has three bores of differing diameters. The forward bore contains a first crimping buffer sleeve 26 of a soft, yet environmentally stable, material such as a pin/lead alloy to enable the forward section 27 of the ferrule 17 to be crimped down to hold the optical fibre 10 without damage. The plastics (silicone resin) cladding on the fibre also provides a cushioning effect. The rearmost bore of the ferrule 17 contains a second crimping buffer sleeve 28 of phenolic resin material to enable a grooved section 29 of the ferrule 17 to be crimped down to securely grip the primary sheath 11 of the optical fibre. The crimping buffer sleeves 26 and 28 spread the crimping load and increase the frictional coupling to the optical fibre. The design

of the ferrule 17 is such that crimping distortions will not adversely affect the fit of the ferrule 17 in the accurately machined bore 21. The end of the main body portion 14 remote from the forward body portion 16 is provided with a tapered bore 30 and an internal thread 31. The outer sheath 13 and the longitudinal tensile strengthening fibres 12 are clamped firmly to the main body portion 14 as follows. A flexible strain relief tail 32 securely fixed to a back-up screw 33 by means of a course thread 34, or a moulding technique, is slipped over the cables outer sheath 13. A cross-cut jaw unit 35 with a serrated bore is pushed backward onto the cable's outer sheath 13 after first pushing back by hand the tensile strengthening fibres 12. The combination of the jaw unit 35 and the lightly held enclosed cable are inserted into the tapered bore 30 and back-up screw 33 tightened to secure the connection. The main body portion 14 might be constructed in two halves which are brought together by means not shown or alternatively it might be formed of a rubber, plastics or metal material which is moulded, clamped or crimped around the forward body portion 16 at its forward end and the secondary sheath 13 at its other end.

It will be noted that the main feature of the connector is the provision of the "strain relieving" chamber 15 through which the fibre 10 and primary sheath 11 passes. As shown the fibre 10 and primary sheath 11 follow an average arcuate path but the elasticity of the fibre 10 allows it to assume a path of greater (ie less length) or less (ie greater lengths) radius of curvature to accommodate any strain which might be put upon the fibre 10 as a result of acts external to the connector without transferring that strain to the fibre 10/ferrule 17 assembly.

The forward body portion 16 is provided with an annular "V"-section projection 36 for accurate alignment of the fibre 10 with a corresponding fibre of the mating part. The forward facing exposed end of the fibre 10/ferrule 17 assembly projects into the space within the annular "V"-section projection 36 which therefore affords a degree of protection.

It will be readily appreciated from the drawing that upon connection of the connector to its mating part the exposed face of the fibre 10/ferrule 17 will interface with the corresponding exposed end of the mating fibre optic system, the interface connection being maintained by the spring 24. The angled main body portion 14 leads the fibre optic cable (fibre 10, primary sheath 11 and secondary sheath 13) away from the connection in a manner less likely to result in inadvertent damage to the fibre 10 as a result of flexing or stressing of the cable at the point where it enters the connector. The angled chamber 15, as previously described, provides a degree of strain relief in the fibre 10 by allowing it to accommodate small changes of its longitudinal position without putting undue strain on the fibre 10/ferrule 17 assembly.

Although the specific example described above refers to 400 micron core plastics cladded fibre it will be readily apparent to those skilled in the art that the principle of the invention is equally applicable to silica, silicate and polymer fibres down to 60—80 microns and also to multi-strand ie bundles of fibres. With all-glass fibres the crimping buffer 24 may need an internal cushioning lining. Furthermore the invention is clearly not limited to the specifically described fibre 10/ferrule 17 assembly and its location within the forward body portion 16 which is but one example only of many design variants.

CLAIMS

1. A fibre optic connector having a fibre mounted ferrule assembly at its connecting end and means in the region of its other end for securely holding the end length of the sheath of the fibre optic cable, and a chamber therebetween through which the fibre extends in a manner whereby strain applied to the fibre externally of the connector is isolated, or substantially so, from the fibre/ferrule assembly.

2. A fibre optic connector as claimed in Claim 1 in which the connector comprises a main body portion including the strain relieving chamber and a forward body portion housing the fibre/ferrule assembly.

3. A fibre optic connector as claimed in Claim 1 or 2 in which the connector is an angled connector with the fibre following an arcuate path through the chamber thereby any strain applied to the fibre is relieved by the elasticity of the fibre in assuming an alternative arcuate path of different radius of curvature.

4. A fibre optic connector as claimed in Claim 1 2 or 3 in which the fibre/ferrule assembly is resiliently retained in the connector.

5. A fibre optic connector as claimed in Claim 4 in which the fibre/ferrule assembly is resiliently retained by a spring acting to urge the exposed end of the fibre against its operative interface position.

6. A fibre optic connector as claimed in any of the preceding claims in which the connecting end of the connector includes alignment means for co-location with the fibre optic system to which the connector is to be connected.

7. A fibre optic connector as claimed in Claim 6 in which the alignment means is an annular "V"-Section projection for co-location with a corresponding annular "V"-Section groove in the mating part.

8. A fibre optic connector substantially as herein before described with reference to the accompanying drawing.

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